In order to establish a prima facie case of obviousness, all of the claimed limitations must be taught or suggested by the prior art. Applicant respectfully submits that Igashira fails to teach or suggest all of the claimed limitations. For example, Igashira fails to teach or suggest:

> "...the composition of said piezoelectric device being a lead zirco-titanate composition, the components of said lead zirco-titanate composition being adjusted so that a relation d(0.1 Ec)/d(1.2 Ec)>0.43 is established, where Ec is coercive electric field which causes the changing of polarizing direction, between an apparent piezoelectric constant d(1.2 Ec) calculated from static elongation when an electric field of 1.2 Ec is applied to said piezoelectric device in the same direction as a polarizing direction while a preset load of 500N is applied to said piezoelectric device, and an apparent piezoelectric constant d(0.1 Ec) calculated from static elongation when an electric field of 0.1 Ec is applied to said piezoelectric device in the same direction as the polarizing direction" as required by independent claim 1.

Furthermore, Igashira fails to teach or suggest:

> "...the composition of said piezoelectric device being a lead zirco-titanate composition, the components of said lead zirco-titanate composition being adjusted so that said piezoelectric device has a change ratio of displacement of 9% or below when a frequency of the applied voltage is changed from 1 Hz to 200 Hz under the state where an AC voltage is applied so that an electric field intensity of 0 to 1.5 kV/mm is generated by a sine wave while a preset load of 500N is applied to said piezoelectric device" as required by independent claim 3.

Also, Igashira fails to teach or suggest:

> "...the composition of said piezoelectric device being a lead zirco-titanate composition, the components of said lead zirco-titanate composition being adjusted so that displacement increases with the rise of temperature within the range of -40°C to 150°C" as required by independent claim 5.

Also, Igashira fails to teach or suggest:

> "...the composition of said piezoelectric device being a lead zirco-titanate composition, the components of said lead zirco-titanate composition being adjusted so that said piezoelectric device has a

dielectric loss of 8% of below calculated from a P-E hysteresis" as required by independent claim 7.

The Office Action even admits that Igashira "fails to disclose a relation d(0.1Ec)/d(1.2Ec)>0.43; said piezoelectric device having a change ratio of displacement of 9% or below when a frequency of the applied voltage is changed from 1 Hz to 200 Hz; wherein the displacement increases with the rise of temperature within the range of -400°C to 1500°C; and having a dielectric loss of 8% or below." (See page 2, section 3 of the Office Action).

Nevertheless, the Office Action has apparently alleged that none of the above claimed features "show(s) a structural feature in the claimed invention." The Office Action further states "It is not supported by claim structure, they are only goals of the invention." (See page 3, section 4 of the Office Action). Applicant respectfully disagrees that the above claimed features are merely "goals of the invention." For example, claims 1, 3, 5 and 7 have been amended to require that the above explicitly claimed features are structural properties (e.g., displacement, dielectric loss etc.) of the physical composition of the claimed piezoelectric layers (structural elements). The above explicitly claimed features are therefore limitations which must be given patentable weight.

Accordingly, Applicant respectfully submits that claims 1-8 are not "obvious" over Igashira and thus respectfully requests that the rejection of claim 1-8 under 35 U.S.C. §103 be withdrawn.

New Claims:

New claims 31-38 have been added to provide additional protection for the invention. New claims 31-38 are method claims generally corresponding to device claims 1-8, respectively.

Conclusion:

Applicant believes that this entire application is in condition for allowance and respectfully requests a notice to this effect. If the Examiner has any questions or believes that an interview would further prosecution of this application, the Examiner is invited to telephone the undersigned.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE IN THE SPECIFICATION:

Paragraph beginning at page 3, line 9 has been amended as follows:

[The most] <u>One</u> noteworthy point in the first aspect of the present invention is that the ratio d(0.1Ec)/d(1.2Ec) is at least 0.43. When the piezoelectric device generates displacement, there exist a piezoelectric displacement component that immediately starts displacement upon application of a voltage and a 90° rotation component that starts displacement with a delay after the application of the voltage, and they together constitute the overall displacement.

Paragraph beginning at page 6, line 4 has been amended as follows:

It is [most] noteworthy in the fifth aspect that displacement increases with the rise of the temperature within the specific temperature range described above.

Paragraph beginning at page 7, line 11 has been amended as follows:

It is [most] noteworthy in this seventh aspect that the piezoelectric device has a dielectric loss of 8% or below determined from a P-E hysteresis. In a graph in which an electric field intensity E is plotted on the abscissa and a charge P, on the ordinate, the P-E hysteresis can be obtained by plotting the trajectory of the value of the charge P when the field intensity is increased up to 1.5 kV/mm and is then lowered (see later-appearing embodiments).

Paragraph beginning at page 8, line 17 has been amended as follows:

It is [most] noteworthy, in the ninth aspect of the present invention, that the piezoelectric device is built and accommodated in the cylindrical accommodation space, and its sectional shape is an octagon or a polygon with a larger number of sides than the octagon.

Paragraph beginning at page 9, line 14 has been amended as follows:

According to the tenth aspect [(claim 20)] of the present invention, there is provided a piezoelectric device for an injector, built in an injector and generating a driving force of the injector, characterized in that the piezoelectric device is fabricated by alternately laminating a plurality of piezoelectric layers expanding and contracting in proportion to an applied voltage and a plurality of internal electrode layers for supplying the applied voltage, at least a part, or the whole, of the sectional shape crossing at right angles the laminating direction is arcuate, and the piezoelectric device is accommodated in a cylindrical accommodation space.

Paragraph beginning at page 9, line 27 has been amended as follows:

It is [most] noteworthy in the tenth aspect of the present invention that the piezoelectric device is built and accommodated in the cylindrical accommodation space, and at least a part, or the whole, of its sectional shape is arcuate. More concretely, when the sectional shape is a polygon, its corners are

rounded to arcs, or a part of the circle is cut into a barrel shape, for example. The radius of curvature of the arcuate shape is preferably close to the radius of curvature of the inner peripheral surface of the cylindrical accommodation space.

Paragraph beginning at page 10, line 22 has been amended as follows:

According to the eleventh aspect [(claim 10, claim 21)] of the present invention, a proximity ratio expressed by (B/A) x 100 (%), where A is the total length of a circumscribed circle of the piezoelectric device and B is the sum of the length of the circumferential portions having a distance of 0.2 mm or below between the circumscribed circle and the piezoelectric device, is preferably larger than 17%. Consequently, heat radiation performance of the piezoelectric device can be further improved, and durability can be improved, too. More preferably, according to the twelfth aspect [(claim 11, claim 22)], the proximity ratio described above is 32% or more, and heat radiation performance can be further improved.

Paragraph beginning at page 10, line 36 has been amended as follows:

According to the thirteenth aspect [(claim 12, claim 23)] of the present invention, at least two side surface portions having a width of 2.5 mm or more are disposed on the side surface parallel to the laminating direction. In this case, the space defined between the side surface flat portions and the inner surface of the cylindrical accommodation space can be effectively utilized, and

side surface electrodes for taking out electrodes can be disposed in the piezoelectric device. Incidentally, disposition of the side electrodes becomes difficult when the width of the side surface flat portion is less than 2.5 mm.

Paragraph beginning at page 11, line 11 has been amended as follows:

According to the fourteenth aspect [(claim 13, claim 24)] of the present invention, an insulating film having a thickness of 0.002 to 0.5 mm is preferably formed on at least the side surface of the piezoelectric device in a direction parallel to the laminating direction. In this way, electric insulation can be secured between the piezoelectric device and the injector accommodating the former, and stable control of the piezoelectric device can be obtained. When the thickness of the insulating film is less than 0.002 mm, sufficient insulation performance cannot be obtained in some cases. When the film thickness exceeds 0.5 mm, on the other hand, heat radiation performance of the piezoelectric device drops.

Paragraph beginning at page 11, line 25 has been amended as follows:

According to the fifteenth aspect [(claim 14, claim 25)] of the present invention, a value R2 - R1, where R1 is a maximum outer diameter of the piezoelectric device inclusive of the insulating member and R2 is an inner diameter of the cylindrical accommodation space, is preferably 0.5 mm or below. Consequently, heat transfer from the piezoelectric device to the cylindrical accommodation space can be further improved.

Paragraph beginning at page 11, line 33 has been amended as follows:

According to the sixteenth aspect [(claim 15, claim 26)] of the present invention, the insulating film is preferably made of any of a silicone resin, a polyimide resin, an epoxy resin and a fluorocarbon resin. When any of these resins is used, excellent heat resistance capable of withstanding a temperature of 150°C or above, for example, can be obtained in addition to a reliable insulating performance.

Paragraph beginning at page 12, line 4 has been amended as follows:

According to the seventeenth aspect [(claim 16, claim 27)] of the present invention, electrode take-out portions electrically connected to the inner electrode layers are preferably disposed on a distal end face and a rear end face of the piezoelectric device in the laminating direction. In this case, the electrode take-out portions need not be disposed on the side surface of the piezoelectric device in a direction crossing at right angles <u>in</u> the laminating direction, and the structure can be further simplified and rendered compact.

Paragraph beginning at page 12, line 14 has been amended as follows:

According to the eighteenth aspect [(claim 17, claim 28)] of the present invention, either one of the distal end face and the rear end face of the piezoelectric device in the laminating direction is preferably equipped with two electrode take-out portions electrically connected to the inner electrode layers.

In this case, electric connection with the piezoelectric device can be established on only one of the end faces. Therefore, not only the structure of the piezoelectric device but also the structure of the arrangement to the injector can be simplified.

Paragraph beginning at page 12, line 25 has been amended as follows:

According to the nineteenth aspect [(claim 18, claim 29)] of the present invention, at least one of the electrode take-out portions is preferably connected electrically to at least one of the inner electrode layers through a through-hole formed in the piezoelectric layers. In this case, the arrangement structure of the electrode take-out portions can be simplified.

Paragraph beginning at page 12, line 32 has been amended as follows:

According to the twentieth aspect [(claim 19, claim 30)] of the present invention, at least one of the electrode take-out portions can take the structure in which it is electrically connected to the side surface electrode disposed on the side surface of the piezoelectric device.

IN THE CLAIMS:

1. (Amended) A piezoelectric device for an injector, built into an injector and generating driving force of said injector, [characterized in that] comprising:

[said piezoelectric device is fabricated by alternately laminating a plurality of piezoelectric layers generating displacement in proportion to an applied voltage and a plurality of internal electrode layers for supplying the applied voltage; and

in said piezoelectric device,] <u>a plurality of piezoelectric layers generating displacement in proportion to a voltage applied to said piezoelectric layers;</u>

<u>a plurality of internal electrode layers for supplying the applied voltage; and</u>

<u>said piezoelectric layers and said internal electrode layers being alternately laminated;</u>

<u>the composition of said piezoelectric layers being a lead zirco-titanate composition, the components of said lead zirco-titanate composition being adjusted so that</u> a relation d(0.1 Ec)/d(1.2 Ec)>0.43 is established, where Ec is coercive electric field which causes the changing of polarizing direction, between an apparent piezoelectric constant d(1.2 Ec) calculated from static elongation when an electric field of 1.2 Ec is applied to said piezoelectric device in the same direction as a polarizing direction while a preset load of 500N is applied to said piezoelectric device, and an apparent piezoelectric constant d(0.1 Ec) calculated from static elongation when an electric field of 0.1 Ec is applied to said piezoelectric device in the same direction as the polarizing direction.

2. (Amended) A piezoelectric device for an injector according to claim 1, wherein the components of the lead zirco-titanate composition establish a relation d(0.1Ec)/d(1.2Ec) ≥ 0.5 [is established] between said piezoelectric constant d(1.2Ec) and said piezoelectric constant d(0.1Ec).

3. (Amended) A piezoelectric device for an injector, built into an injector and generating driving force of said injector, [characterized in that] comprising:

[said piezoelectric device is fabricated by alternately laminating a plurality of piezoelectric layers generating displacement in proportion to an applied voltage and a plurality of internal electrode layers for supplying the applied voltage; and]

a plurality of piezoelectric layers generating displacement in proportion to a voltage applied to said piezoelectric layers;

a plurality of internal electrode layers for supplying the applied voltage; and

said piezoelectric layers and said internal electrode layers being alternately laminated;

the composition of said piezoelectric layers being a lead zirco-titanate composition, the components of said lead zirco-titanate composition being adjusted so that said piezoelectric device has a change ratio of displacement of 9% or below when a frequency of the applied voltage is changed from 1 Hz to 200 Hz under the state where an AC voltage is applied so that an electric field

intensity of 0 to 1.5 kV/mm is generated by a sine wave while a preset load of 500N is applied to said piezoelectric device.

4. (Amended) A piezoelectric device for an injector according to claim [1] 3, wherein said change ratio of displacement is 7% or below.

5. (Amended) A piezoelectric device for an injector, built in an injector and generating driving force of said injector, [characterized in that] comprising:

[said piezoelectric device is fabricated by alternately laminating a plurality of piezoelectric layers generating displacement in proportion to an applied voltage and a plurality of internal electrode layers for supplying the applied voltage; and

in said piezoelectric device,] a plurality of piezoelectric layers generating displacement in proportion to a voltage applied to said piezoelectric layers;

a plurality of internal electrode layers for supplying the applied voltage; and

said piezoelectric layers and said internal electrode layers being alternately laminated;

the composition of said piezoelectric layers being a lead zirco-titanate composition, the components of said lead zirco-titanate composition being

adjusted so that the displacement increases with the rise of temperature within the range of -40°C to 150°C.

6. (Amended) A piezoelectric device for an injector according to claim 5, wherein the components of the lead zirco-titanate composition is adjusted so that said change ratio of displacement is 5 to 40% within the range of temperature of -40°C to 150°C.

7. (Amended) A piezoelectric device for an injector, built in an injector and generating driving force of said injector, [characterized in that] comprising:

[said piezoelectric device is fabricated by alternately laminating a plurality of piezoelectric layers generating displacement in proportion to an applied voltage and a plurality of internal electrode layers for supplying the applied voltage; and]

a plurality of piezoelectric layers generating displacement in proportion to a voltage applied to said piezoelectric layers;

a plurality of internal electrode layers for supplying the applied voltage; and

said piezoelectric layers and said internal electrode layers being alternately laminated;

the composition of said piezoelectric layers being a lead zirco-titanate composition, the components of said lead zirco-titanate composition being

adjusted so that said piezoelectric device has a dielectric loss of 8% or below calculated from a P-E hysteresis.

8. (Amended) A piezoelectric device for an injector according to claim 7, wherein the components of said lead zirco-titanate composition being adjusted such that said dielectric loss is 7% or below.